positions discuss simple cases of the problem of points when there are two or three players; the method is similar to that of Pascal. The remaining five propositions deal with questions relating to dice, after which Huygens gives five exercises without demonstrations, which are left to the reader. Three of these had been proposed to Huygens by Pascal and Fermat. Their solution afterwards occupied Hudde, De Moivre, James Bernoulli, and others, and the generalisations to which they led had an important influence on the development of the theory of probability.

Several of the most valuable works of Huygens were published long after they were written, whereby he lost the priority of various important discoveries. Thanks to van Schooten, the treatise on probability was promptly issued, and it remained for more than fifty years the only introduction to the theory. Two English translations appeared, and James Bernoulli reprinted it in his "Ars conjectandi." Huygens continued up to 1688 to occupy himself occasionally with questions arising out of his treatise, and the five exercises at the end of it. He never published any of his notes, but they are now printed in the form of nine appendices. The same methods are followed in them as in the treatise.

The remaining two-thirds of the volume contain various mathematical studies from the years 1655 to 1666. Among these are some dealing with the theory of numbers, and particularly with the equation known as Pell's, $ax^2+1=y^2$, where a is an integer which is not a square. Other notes discuss problems of rectification or quadrature, or examine the properties of the cycloid and other curves. Many of the results thus found were published by Huygens in 1673 in his "Horologium oscillatorium," but without proofs and without any clue to the way in which they were found. The studies now printed for the first time thus form a valuable supplement to that work and throw much light on the methods he employed to discover the results announced in it. A similar case is the "rule for finding logarithms" which Huygens communicated to the Paris Academy in 1666 without explanation or proof, and which was first found in the Archives of the Academy and published by Bertrand in 1868. It was suggested by Bertrand that Huygens must have known and used the series $\log(1+x)=x-\frac{1}{2}x^2+\frac{1}{3}x^3- \ldots$ We see now that this was not the case, but that Huygens used a method founded on an approximate quadrature of the hyperbola deduced from a theorem which he had published in 1651.

Huygens also contributed to the solution of one of the burning questions of the day, the drawing of tangents to algebraic curves. His notes on the subject are given in the present volume. He found, however, when the third volume of Descartes's Letters came out in 1667, that he had been anticipated. This was fully acknowledged by Huygens in a paper published by the Academy in 1693, in which the priority of Sluse and Hudde is recognised. The papers communicated by Huygens to the Paris Academy, and everything connected with them, are to be published in a later volume of the "Œuvres complètes."

J. L. E. D.

Four Aspects of Parenthood.

The Control of Parenthood. By Prof. J. Arthur Thomson and Others. With an introduction by the Bishop of Birmingham. Edited by Dr. James Marchant. Pp. xi+203. (London and New York: G. P. Putnam's Sons, 1920.) 7*s*. 6*d*. net.

DURING the past seven years the National Birth-rate Commission has been sitting, and it has published two reports, one in 1916, entitled "The Declining Birth-rate: its Causes and Effects," and the other, called "Problems of Population and Parenthood," in 1920. Smaller volumes have already sprung up around these large reports, and they have dealt with certain aspects or phases of the great general question of the falling birth-rate and all it may involve. One of these smaller books is the work before us; it contains short essays on four aspects of the subject—the biological, the economic, the social and religious, and the Imperial and racial; there is an introduction by the Bishop of Birmingham, and the whole is edited by Dr. James Marchant, who is the secretary of the National Birth-rate Commission itself.

The biological aspects are considered by Prof. J. Arthur Thomson, of Aberdeen University, whose fascinating works on natural history and sex are an assurance that facts will be found here clearly and attractively stated; and Prof. Leonard Hill, whose research work in physiology gives him every right to speak with authority upon such a subject as the present. Dean Inge and Mr. Harold Cox write on the economic aspects; Dr. Mary Scharlieb, the Rev. F. B. Meyer, and Principal A. E. Garvie represent the social and religious aspects; and Sir Rider Haggard, the novelist, and Marie Carmichael Stopes, the doctor of science and philosophy, deal with the Imperial and racial side of the matter. All the birds in this little nest of authors are not, however, singing in tune, and, in

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particular, Dr. Mary Scharlieb, the doctor of medicine, differs in emphatic terms from Dr. Marie Stopes, the doctor of science and philosophy.

The second, third, and fourth aspects of the subject of the control of parenthood scarcely fall to be reviewed in a journal like NATURE, but the first may fairly claim notice. Prof. Hill's contribution is rather too closely packed with facts regarding embryology, pregnancy, housing, and food to be grasped easily in its significance; but its author is sturdily opposed to artificial means of preventing conception which "demand a premeditated act in what should be a natural function and disturbs the normality of the sexual act." Such a use of preventives tells also far more against the woman than the man. Prof. Hill sees the risks, the physiological risks as well as the social, of the only child. His solution of the problem of keeping down the vigour of sexual desire is "a wisely regulated diet, *plus* hard physical exercise and occupation."

Prof. J. Arthur Thomson, from the point of view of biology, writes with all his accustomed picturesqueness of imagery, but the brilliancy of his phrasing is somewhat of a danger, and may even constitute a sort of verbal camouflage, a risk which he himself seems to recognise when in his closing paragraph he says: "We must not, however, look at things too biologically . . . we are mind-and-body creatures, and the greatest thing in human life is love." After enumerating all the evils which may arise from birth control, he directs attention to the fact that the good side of the reduction of the birth-rate deserves more consideration than it usually receives. It may improve the health of both mothers and children, give quality for quantity, render life less anxious and earlier marriage more practicable, work against war, make woman's position more independent, and so forth. His contrast between the keeping up of numbers by the fertility or spawning method, with its unlimited production of lives the majority of which almost immediately cease, and by what he finely designates "economised reproduction associated with increased parental care," is absolutely conclusive in favour of the latter plan.

The spawning solution among the lower animals themselves is less effective in the long run than that which Peripatus adopted—viz. the giving birth to a few miniature adults ready at once to fend for themselves. "The tapeworm, with its degenerate body and drifting life of ease, has its millions of embryos; the golden eagle, with its differentiated body and controlled life, has two eaglets at a time." Yet it is not securely known that high individuation directly lessens fertility, for whilst some of the greatest men were childless a fair list of famous fathers can be made out. After all, the strictly scientific or the rigidly biological aspect of human reproduction refuses to be dissociated from the other ways of looking at things; and Prof. Thomson closes with words which have weight: "If we lose the adventurousness of early marriage on meagre material resources, and the delight of having children while we are young enough to sympathise with them, we are missing some of the fragrant flowers of life."

Our Bookshelf.

Recueil de l'Institut Botanique Léo Errera (Université de Bruxelles). Publié par L. Errera. Tome iv. Pp. xi + 653 + plates. (Brussels: Maurice Lamertin, 1920.) 50 francs.

THIS ponderous volume contains a selection of papers published in various scientific journals from 1885 to 1900 by the late Léo Errera and other Belgian botanists. There are a few short communications by Errera at the beginning of the volume of a general nature, such as those on the law of the conservation of life, spontaneous generation, and the mechanism of sleep. The volume is mainly a collection of papers on plant cytology and on the physiology of organisms of simple structure. Workers specially interested in these branches will appreciate the advantage of associating in one volume a number of papers scattered through many different journals, but as all these journals are fairly accessible the production of a great mass of reprints may seem somewhat extravagant in view of the difficulties attending scientific publication at the present time.

The volume contains thirty-two papers in all; nineteen, mostly brief, are by Errera, including one in which the inheritance of acquired characters in a mould-fungus (Aspergillus) is maintained; others deal with protoplasmic movement, the ascent of sap, and an apparatus to demonstrate the mechanism of stomates. Communications by E. Laurent and G. Bullot deal with the physiology of growth and curvature of the fungus Phycomyces; and Jean Massart discusses the sensibility to various external influences of unicellular organisms under several headings. The irritability of Noctiluca he describes as analogous to that of the Sensitive Plant, the essential difference lying only in the manner of the reaction. The longest paper is by E. de Wildeman (published in 1893) on the formation of the dividing wall in cells; the subjects of study were mainly species of mosses and brown and red seaweeds.

Manuel de Topométrie. Opérations sur le Terrain et Calculs. By Jules Baillaud. Pp. vii + 222. (Paris: H. Dunod, 1920.) 13 francs.

IN this book Capt. Baillaud sets down his war experience in the preparation of the plans neces-

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